Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period:\_\_\_\_\_\_\_

Natural Selection and Evolution Videos

Directions: Watch the videos and answer the questions. You may use notes or the textbook to help you.

Rock Pocket Mice: Natural Selection and Adaptation (HHMI)

YouTube link: https://youtu.be/sjeSEngKGrg

Or search “Natural Selection and the Rock Pocket Mouse — HHMI BioInteractive Video”

1. Define “mutation.”

2. Is the following statement true or false? Justify your answer in one or two sentences: “Mutations are caused by selective pressure in the environment.”

3. Is the following statement true or false? Justify your answer in one or two sentences: “The same mutation could be advantageous in some environments but deleterious in others.”

4. Is the following statement true or false? Justify your answer in one or two sentences: “The appearance of dark colored volcanic rock caused the mutation for black fur to appear in the rock pocket mouse population.”

5. Explain how the environment plays a role in changing the frequency of a mutant allele in a population.

6. As you saw in the film, rock pocket mice evolved to have dark-colored fur in certain habitats. In three to five sentences, explain how this trait increased in frequency in the population. Include the following key terms: “fitness” (or “fit”), “survival” (or “survive”), “selection” (or “selective”), and “evolution” (or “evolve”).

*Note: In biology “fitness” is a relative measure of a how much a trait makes an individual more likely to survive and reproduce. Being “fit” does not necessarily mean the organism is in better physical shape and/or stronger than others (as we typically use “fit” to mean), it means that an organism has traits that allow it to survive and reproduce in its environment.*

7. Near the end of the film, Dr. Sean B. Carroll states that “while mutation is random, natural selection is not.” In your own words, explain how this is possible.

8. Suppose you are studying a recently discovered population of rock pocket mice with dark-colored fur that lives on volcanic rock. You take a DNA sample from a member of this new population and determine the DNA sequence of a gene known to play a role in fur color. The sequence you get is identical to that of the same gene in another rock pocket mouse population with dark-colored fur that lives on a different patch of volcanic rock. Which of the following could explain this observation?

a. The mice in the two populations evolved from the same ancestral population.

b. The volcanic rock caused the same mutation in each rock pocket mouse population, resulting in dark coloration.

c. The same mutation spontaneously arose in the two different populations.

d. Both (a) and (c) are possible.

e. All of the above are possible.

Sickle cell and malaria: Natural Selection in Humans (HHMI)

YouTube link: https://youtu.be/Zsbhvl2nVNE

Or search “Malaria and Sickle Cell Anemia — HHMI BioInteractive Video”

1. Consider the statement: “Sickle cell disease is a(n) \_\_\_\_\_\_\_\_\_ disease.” Which of the following terms could fill in the blank to make the statement true? Write “yes” or “no” next to each possible response. There may be more than one correct answer.

Genetic \_\_\_\_\_\_\_\_\_\_\_\_ Infectious \_\_\_\_\_\_\_\_\_\_\_\_ Potentially lethal \_\_\_\_\_\_\_\_\_\_\_\_ Inherited \_\_\_\_\_\_\_\_\_\_\_\_

2. Consider the statement: “Malaria is a(n) \_\_\_\_\_\_\_\_\_ disease.” Which of the following terms could fill in the blank to make the statement true? Write “yes” or “no” next to each possible response. There may be more than one correct answer.

Genetic \_\_\_\_\_\_\_\_\_\_\_\_ Infectious \_\_\_\_\_\_\_\_\_\_\_\_ Potentially lethal \_\_\_\_\_\_\_\_\_\_\_\_ Inherited \_\_\_\_\_\_\_\_\_\_\_\_

3. Consider the statement: “An individual with two normal copies of the hemoglobin gene is said to be \_\_\_\_\_\_\_\_\_\_.” Which of the following terms could fill in the blank to make the statement true? Write “yes” or “no” next to each possible response. There may be more than one correct answer. (Note that a “locus” is a location on a chromosome.)

Homozygous at the hemoglobin locus \_\_\_\_\_\_\_\_\_\_\_ Susceptible to malaria \_\_\_\_\_\_\_\_\_\_\_

Heterozygous at the hemoglobin locus \_\_\_\_\_\_\_\_\_\_\_ An identical twin \_\_\_\_\_\_\_\_\_\_\_

4. At the beginning of the film, you were introduced to Davaun and Skyy Cooper, who both have sickle cell disease. Which of the following must be true about their parents?

a. One parent has at least one copy of the sickle cell allele.

b. Both parents have at least one copy of the sickle cell allele.

c. Both parents have sickle cell disease.

d. One parent has sickle cell disease.

5. In three to five sentences, explain why sickle cell disease became so prevalent in certain East African populations.

6. There are now several effective antimalarial drugs that can treat people who have malaria or prevent them from getting the disease altogether. Predict what will happen to the frequency of the sickle cell allele as these drugs become more widely used. Support your answer with at least one piece of evidence from the film.

7. If sickle cell disease were caused by only one copy of the sickle cell allele, do you expect the frequency of the sickle cell allele to increase, decrease, or remain the same in places where there is a high incidence of malaria? Explain your answer in two or three sentences.

8. Due to climate change, the range of malaria is expected to spread to areas where it was previously not a problem. Given this piece of evidence, predict what will happen to the frequency of the sickle cell allele in areas where malaria is introduced.

9. Is the following statement true or false? “Malaria caused the sickle cell allele to appear.” Justify your answer in one or two sentences.